



Oregon

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Tom McCue, Environmental Manager
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**Re: Focused Feasibility Study
Siltronic Corporation
Portland, Oregon
ECSI No. 183**

Dear Mr. McCue:

The Department of Environmental Quality (DEQ) has reviewed the "Focused Feasibility Study - Siltronic Corporation, Portland, Oregon" dated October 23, 2007 as amended by a December 19, 2007 letter (VOC Plume FFS). Maul Foster Alongi, Inc. prepared the VOC Plume FFS on behalf of the Siltronic Corporation (Siltronic). The VOC Plume FFS presents Siltronic's evaluation of removal action (i.e., source control measures [SCMs]) alternatives to mitigate contamination migrating to the Willamette River and its sediments via the groundwater pathway. Siltronic developed the VOC Plume FFS consistent with DEQ Order No. VC-NWR-03-16 (the VOC Order). Under the VOC Order, Siltronic is required to: 1) conduct a remedial investigation (RI) of releases of "trichloroethene (TCE) and its degradation byproducts and/or additives" (collectively referred to as "VOCs" in this letter); and 2) for unpermitted discharges or releases of VOCs to the Willamette River, identify and implement SCMs, if necessary.

The primary purpose of this letter is to inform Siltronic that based on our review of the VOC Plume FFS and supporting documents, DEQ does not concur with Siltronic's recommendation (Alternative 3) to use enhanced in-situ bioremediation (EIB) in the northern portion of the facility near the shoreline. DEQ has determined that Siltronic should move forward with developing a plan to implement EIB in the vicinity of the former solvent underground storage tank system (Former UST System), and contribute to the planning, design, and implementation of source control measures (SCMs) aimed at controlling and containing contamination migrating to the river.

The remainder of this letter provides background on the investigative and regulatory status of the northern portion of the Siltronic site; DEQ's rationale for not selecting EIB as an SCM near and along the shoreline, and comments regarding using EIB in the vicinity of the Former UST System and control and containment SCMs near the river.

BACKGROUND

Consistent with Item #1 above, Siltronic submitted an RI Report¹ that presents the work completed to evaluate the lateral and vertical extent of VOCs in soil and groundwater in the uplands, and river

¹ Maul Foster Alongi, Inc., 2007, "Remedial Investigation Report, Siltronic Corporation – Portland, Oregon," April 16, a report prepared on behalf of the Siltronic Corporation.

sediment, transition zone water (TZW), and groundwater off-shore of the northern portion of the Siltronic facility. The RI Report also evaluates the potential risk to human health and ecological receptors from exposure to VOCs in soil, river sediment, groundwater, and surface water.

The RI Report documents that: 1) historic releases of VOCs from the Former UST System have impacted groundwater beneath the northern portion of the Siltronic facility; 2) groundwater is a complete contaminant transport pathway from the Former UST System to the Willamette River; and 3) VOCs are present in groundwater and TZW immediately beneath the river at concentrations that exceed Joint Source Control Strategy² (JSCS) screening criteria. Groundwater contamination that has migrated from the Former UST System to the river is referred to as the “VOC Plume” in this letter. The expression of the VOC Plume on the bottom of the Willamette River channel has been designated “Area 1” by Siltronic in their submittals. Based on a preliminary evaluation presented in the RI Report, Siltronic concluded the VOC Plume is a medium priority for source control.

In addition to the VOC Plume, an area of significant VOC sediment contamination was discovered in the Willamette River during the course of the Siltronic RI. The impacted area, identified as Area 2 by Siltronic, is located within approximately 50 feet northeast of where the combined storm water/treated wastewater line (i.e., Outfall #1) for the Siltronic facility discharges to the river. Based on uplands and in-water investigations completed to date, Area 2 does not appear to be associated with the VOC Plume. Drilling and sampling conducted near and along the alignment of Outfall #1 does not indicate it to be an ongoing source of contamination. Based on the information summarized above, Siltronic suspects Area 2 is the result of historic releases to the storm water conveyance system from a TCE stripper system formerly used at the facility.

Based on the results of a technology screening and laboratory bench scale tests and with DEQ’s concurrence, Siltronic pilot tested an enhanced in-situ bioremediation (EIB) treatment technology. The technology involves injecting a slurry of controlled-release carbon and zero-valent iron (i.e., EHC) into the subsurface, followed by bioaugmentation with a commercial culture of VOC-degrading dehalobacteria (i.e., KB-1). Siltronic conducted the pilot test per a DEQ-approved work plan³ in the vicinity of the Former UST system (i.e., Source Zone Pilot Study Area [SZPSA]) and in a downgradient portion of the VOC Plume near the river (i.e., Riverbank Pilot Study Area [RBPSA]) to assess the effectiveness of the EHC/KB-1 treatment combination under the range of subsurface conditions present in these two areas. Based on the results of the EIB Pilot Study, Siltronic concluded that EIB: 1) was effective in reducing VOC concentrations; and 2) should be further evaluated as a SCM in the VOC Plume FFS. This letter provides DEQ written concurrence with these conclusions.

² EPA and DEQ, 2005, “Portland Harbor Joint Source Control Strategy – Final,” December (note Table 3-1 revised July 16, 2007), a guidance document prepared jointly by the US Environmental Protection Agency and Oregon Department of Environmental Quality.

³ Maul Foster Alongi, Inc., 2006, “Final Enhanced Bioremediation Pilot Study Work Plan - Siltronic Corporation, Portland, Oregon” July 28, a work plan prepared on behalf of Siltronic.

The portion of the Siltronic site contaminated by VOCs occurs within a larger area of manufactured gas plant (MGP) waste and associated contamination (MGP contamination) that is attributed to the historic operations of the former “Gasco Site.” The NW Natural Gas Company (NW Natural) has submitted RI⁴ and human health/ecological risk assessment⁵ reports for the Gasco Site and is conducting RI work to assess the nature and extent of MGP contamination on the property owned by Siltronic (Siltronic Property). NW Natural is conducting the RI work as required by Voluntary Agreement DEQ No. WMCVC-NWR-94-13 (dated August 8, 1994) as amended by Addendum #1 dated July 19, 2006 (collectively referred to as the “Agreement” in this letter). NW Natural’s RI of the Siltronic Property includes assessing the nature and extent of MGP contamination and evaluating potentially complete and/or significant human health and ecological exposure pathways in the uplands and to offsite areas.

Source Control Determination

Based on the work completed by Siltronic and NW Natural, DEQ determined that the northern portion of the Siltronic Property and the shoreline of the adjoining Gasco Site (i.e., property owned by NW Natural) are high priorities for source control. The portion of the shoreline identified as the highest priority for source control (Segment 1) extends from downstream of the “Tar Body Removal Area” (TBRA) on the NW Natural Property, to upstream of the “lowland effluent pond overflow area”⁶ (EPOA) on the Siltronic Property. This segment coincides with the heaviest MGP-related impacts identified near the river, including dense non-aqueous liquids (DNAPLs), impacted riverbank soils, and contaminated groundwater. It also includes the portion of the Siltronic Property where groundwater contamination caused by Siltronic has commingled with MGP-related DNAPL and groundwater contamination from the former Gasco Site. The segment of NW Natural’s shoreline between the TBRA and NW Natural’s downstream property line with US Moorings (Segment 2) is considered a high priority for source control primarily due to the presence MGP contamination, particularly cyanide, in riverbank soils and groundwater.

Siltronic and NW Natural Focused Feasibility Studies

The VOC Plume FFS specifically addresses the VOC Plume in the northern portion of the Siltronic Property, and does not address Area 2 or MGP contamination. Siltronic acknowledges that Area 2 will require in-water removal action(s) that are beyond the scope of the VOC Plume FFS. Impacts to the Willamette River or its sediments requiring removal actions and/or remedial actions are subject to oversight by the U.S. Environmental Protection Agency (EPA).

⁴ Hahn and Associates, Inc., 2007, “Remedial Investigation Report, NW Natural - Gasco Facility, 7900 NW St. Helens Road, Portland, Oregon,” April 30, a report prepared for NW Natural.

⁵ Anhor Environmental, LLC, 2004, “Revised Baseline Ecological and Human Health Risk Assessment Report, NW Natural ‘Gasco’ Site,” December, a report prepared on behalf of NW Natural.

⁶ The “Tar Body Removal Area” and the “lowland effluent overflow area” are features associated with the historic operations of the former Gasco Site. The TBRA was subject to an EPA early action conducted in the late-summer/early-fall 2005.

Regarding MGP contamination in the northern portion of the Siltronic Property, per the Agreement NW Natural submitted an MGP DNAPL/Groundwater FFS⁷ that evaluates and recommends SCMs alternatives to: 1) mitigate migration of MGP DNAPL and contaminated groundwater to the Willamette River along shoreline segments 1 and 2 (i.e., vertical barrier combined with hydraulic control/containment); and 2) stabilize riverbank soils along the shoreline of the NW Natural Property. As such, the scope of the MGP DNAPL/Groundwater FFS overlaps with the VOC Plume FFS in the northern portion of the Siltronic Property.

Joint Order

DEQ Order No. ECVC-NWR-00-27 (the Joint Order) dated October 4, 2000, requires NW Natural and Siltronic to, "...identify, characterize, and evaluate any unpermitted discharge or migration of contaminants to the Willamette River or its sediments identified in the RI, and, as necessary, develop and implement source control measures to address such releases." Under the Joint Order and consistent with the JSCS, DEQ considers both companies responsible for: 1) identifying complete contaminant transport pathways to the Willamette River and sediment; and 2) evaluating SCMs for high priority pathways.

Currently, EPA and DEQ consider the off-shore areas of the Siltronic and NW Natural properties to be a potential candidate for early action. DEQ has also determined it will be unlikely that the uplands RI and feasibility study (RI/FS) of the Siltronic and NW Natural properties will be complete by the time the Record of Decision for Portland Harbor has been finalized. As such, DEQ has established short-term source control goals for the most heavily impacted portions of the Siltronic and NW Natural shorelines, including: 1) evaluating and selecting SCMs that effectively mitigate contaminant migration to the river; 2) expediting planning and design of the SCMs; 3) finalizing design(s) and implementing SCMs in coordination with EPA, but in advance of an in-water early action.

DEQ also considers it a priority for the RI/FS to move forward concurrently with development and implementation of the SCMs. The RI/FS will include evaluation of proven, effective, and feasible remedial action alternatives for addressing MGP contamination in the uplands portions of the Siltronic and NW Natural properties. DEQ has informed Siltronic and NW Natural that during the time it takes to complete uplands work, it is essential for the companies to select and implement compatible SCMs to meet the requirements of the Joint Order and the goals of the JSCS for the VOC Plume and MGP contamination migrating to the river.

VOC PLUME FOCUSED FEASIBILITY STUDY

DEQ's comments regarding the VOC Plume FFS are provided below. Although not specifically identified in this letter, these comments reflect our review of the EIB Pilot Study⁸ and MGP

⁷ Anchor Environmental, LLC, 2007, "Groundwater/DNAPL Source Control Focused Feasibility Study, NW Natural 'Gasco' Site," November, a report prepared for NW Natural.

⁸ Maul Foster Alongi, Inc., 2007, "Enhanced In-Situ Bioremediation Pilot Study Report - Siltronic Corporation, 7200 NW Front Avenue, Portland, Oregon, 97210," August 9, a report prepared for Siltronic.

DNAPL Desorption Assessment⁹. As the VOC Plume FFS has been prepared in large part based on these two submittals, DEQ will not comment on these documents further. As discussed above, because the area off-shore of the Siltronic and NW Natural properties is considered a candidate(s) for early action, DEQ has prioritized source control-related work at both facilities. As such, DEQ's review of the RI Report is ongoing and a comments letter pertaining to the RI Report will be prepared sometime following our review of the VOC Plume FFS and MGP DNAPL/Groundwater FFS.

Given the status of the NW Natural and Siltronic properties in the Portland Harbor, DEQ provided copies of the VOC Plume FFS to the EPA. In addition, the Oregon Department of State Lands (DSL) and the Tribes shared consultant¹⁰ requested copies. The EPA and DSL did not provide comments to the document. A copy of the Tribes consultant's comments is attached. Although the DEQ and the Tribes consultant share many comments, Siltronic should closely review the attachment to ensure that all comments are fully considered and addressed in future documents.

The VOC Plume FFS evaluates six SCMs alternatives scenarios for the VOC Plume in the northern portion of the Siltronic Property. Four of the alternatives utilize EIB. The alternatives scenarios are summarized below.

- Alternative 1 - no action
- Alternative 2 – treatment of the VOC Plume using EIB in the vicinity of the Former UST System without hydraulic containment/capture along the riverbank (Alternative 2A), or with hydraulic containment/capture (implemented by NW Natural) along the riverbank (Alternative 2B)
- Alternative 3 - treatment of the VOC Plume using EIB in the vicinity of the Former UST System and along the riverbank without hydraulic containment/capture; or with hydraulic containment (implemented by NW Natural) sequenced on a schedule established by Siltronic (Alternative 3A); or with hydraulic containment/capture (implemented by NW Natural) (Alternative 3B) without sequencing
- Alternative 4 - treatment of the VOC Plume using EIB in the vicinity of the Former UST System and along the toe of the riverbank without hydraulic containment/capture, or with hydraulic containment (implemented by NW Natural) sequenced per a schedule established by Siltronic (Alternative 4A), or hydraulic containment/capture (implemented by NW Natural) without sequencing (Alternative 4B)
- Alternative 5 – treatment of the VOC Plume using EIB in the vicinity of the Former UST System and hydraulic containment along the riverbank by Siltronic (i.e., Alternative 2B equivalent)
- Alternative 6 – hydraulic containment along the riverbank by Siltronic without EIB

⁹ Maul Foster Alongi, Inc., 2007, "TCE Desorption Bench Test Results - Siltronic Corporation, 7200 NW Front Avenue, Portland, Oregon – ECSI #183," June 26, a letter report prepared on behalf of Siltronic.

¹⁰ Stratus Consulting, Inc. reviewed the VOC Plume FFS on behalf of the Confederated Tribes of Grand Ronde, Siletz Department of Natural Resources, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of Warm Springs.

Siltronic compared each SCM alternative to DEQ balancing factors including effectiveness, long-term reliability, implementability, and implementation risk, and determined that Alternative 3A scored the highest. Based on the SCM alternatives analysis, Siltronic recommends that Alternative 3A be implemented at the site.

Besides scoring the highest, DEQ understands that Siltronic considers Alternative 3A to have the following advantages compared to the other SCMs alternatives evaluated:

- Absent interference by hydraulic capture/containment SCMs, groundwater treated by EIB along the riverbank will address the portion of the VOC Plume that occurs under the river.
- EIB represents a “treatment” rather than containment strategy for reducing VOC concentrations in the Former UST System vicinity and under the river.
- Time for implementing EIB along the riverbank is less than SCMs evaluated by NW Natural, or those reliant on finalizing the Portland Harbor Record of Decision (i.e., after 2010), resulting in reduction of VOCs under the river sooner.

In addition, Siltronic has suggested that concentrations of certain inorganic analytes (e.g., arsenic, manganese, and free cyanide) could be reduced downgradient of the EIB SCM.

Source Control Measures Evaluation and Selection

Based on review of the VOC Plume FFS and supporting documents, DEQ does not concur with Siltronic’s recommendation regarding Alternative 3A, and selects the SCM that treats the VOC Plume using EIB in the vicinity of the Former UST System combined with SCMs designed to control and contain contamination migrating to the river (i.e., Alternative 2B or Alternative 5). The selection of control and containment SCMs will be an outcome of DEQ’s review of the MGP DNAPL/Groundwater FFS.

DEQ acknowledges data that suggest EIB reduces free cyanide concentrations in groundwater, however the pilot study confirms that EHC/KB-1 has little if any influence on MGP contamination. DEQ indicated previously that because the EHC/KB-1 treatment combination is intended for VOCs only, use of EIB at the riverbank was contingent on the VOC Plume FFS conclusively showing that: 1) the overall schedule for implementing SCMs capable of mitigating the VOC Plume and MGP contamination (VOC/MGP impacts) would not be delayed; 2) the reduction in risk associated with decreases in dissolved phase VOCs justifies the risk of implementation; and 3) there is a clear benefit of EIB over natural biodegradation and/or other measures. Siltronic responded to these items in the VOC Plume FFS; however DEQ concludes that the potential exists for EIB to interfere with the implementation and effectiveness of alternative SCMs that have the capability of mitigating VOC/MGP impacts. DEQ also remains concerned that groundwater chemistry changes caused by EIB could migrate to the river. DEQ’s reasons for not approving using EIB along the riverbank are further discussed below.

Treatment, Containment, and MGP Contamination. Siltronic emphasizes that EIB represents a groundwater treatment versus containment strategy. Consistent with the JSCS, the focus of assessing SCM alternatives is upland source control and not in-water remediation. DEQ

acknowledges Siltronic's efforts to address in-water impacts, however including a removal action objective (RAO) specifically for Area 1 (i.e., downgradient RAO #2) significantly influences the evaluation of upland SCMs. Many SCM alternatives that include containment as a component are judged less effective because they may alter advection of treated groundwater downgradient under the river, not because they are less effective in controlling contaminant migration from the uplands to the river.

Siltronic indicated the success of implementing EIB near the river relies on having adequate time for treated groundwater to migrate through the VOC Plume and to the river. However, this approach allows continued discharge of VOC impacts to the river until EIB-treated groundwater replaces contaminated groundwater. Dissolved MGP constituents will continue to migrate to the river regardless. As discussed during previous Siltronic-DEQ meetings, there are alternative SCMs being evaluated, including hydraulic control/containment, that can intercept and control migration of groundwater contaminated by VOCs and MGP-related constituents, reducing total contaminant flux to the river as a result.

DEQ considers SCMs that are designed to mitigate VOC/MGP impacts to be more effective approaches for meeting the overall source control objectives for the northern portion of the Siltronic Property.

Potential Interference with Alternative Source Control Measures. There are physical (space) limitations that could restrict implementation of SCMs along the riverbank. Siltronic informed NW Natural and DEQ that vibration is a significant factor for their operations. The two companies are currently developing a vibration monitoring and testing protocol to assess vibrations caused by different vertical barrier construction methods.

As shown in Figure 4-1, the estimated width of the EIB treatment zone near the riverbank is 25 feet. If EIB is implemented along the top of the riverbank, this would necessitate moving alternative SCMs (e.g., vertical barrier and/or extraction wells) closer to Fab 1. Shifting alternative SCMs closer to the fab would likely increase the level of vibration within the building. Installation of the PRB at the base of the riverbank could reduce vibration effects, but would increase the potential for injectate to negatively impact water quality. As noted by Siltronic in the VOC Plume FFS, implementing EIB along the base of the riverbank could result in direct releases of injectate into the river. Potential river impacts are discussed further below.

Using EIB along the top of the riverbank could also create space limitations for implementing SCMs on the NW Natural Property. Figures 1-3b and 1-3c of the VOC Plume FFS suggest the VOC Plume near the riverbank extends onto the Gasco Site. This observation is supported by groundwater monitoring data collected in June – July 2007 by NW Natural that identified *cis*-1,2-DCE (162 micrograms per liter [ug/L]) in monitoring well MW-05-100. NW Natural will further assess these data during future monitoring events; however it appears there is the potential for the VOC Plume to occur on the NW Natural Property. This information is not discussed in the VOC Plume FFS, but if Siltronic's goal was to apply EIB across the width of the VOC Plume, then extension of the SCM further north would warrant additional evaluation.

Alternative Source Control Measures Implementation Delays. Alternative 3 requires that hydraulic capture/control SCMs be postponed for at least one year. During this time Siltronic indicates that treated groundwater will advectively migrate downgradient and reduce VOC concentrations in TZW to less than JSCS criteria. DEQ considers the projected one year timeframe to be underestimated for the following reasons.

- The one year timeframe essentially translates into an expectation that groundwater and TZW under the river will be addressed after flushing the VOC Plume with a single pore volume of treated groundwater. In situations where the objective is to reduce VOC concentrations in groundwater from part per million to low part per billion levels, it is reasonable to anticipate multiple pore volume flushes being needed. This scenario is made more likely if DNAPL with sorbed TCE is present within and downgradient of the riverbank treatment zone, a situation DEQ considers likely based on data collected in the northern portion of the site.
- Siltronic assessed the horizontal hydraulic conductivity (K_h) of alluvial materials at selected monitoring wells located near the top of the bank to a depth of approximately 160 feet below ground surface using a variety of methods (e.g., laboratory tests; short-term pumping tests and slug tests conducted at monitoring wells). Values of K_h estimated from test results vary over one to two orders of magnitude for similar depth intervals. The K_h estimates were used to generate a range of average linear groundwater velocities. Siltronic used a velocity estimate of 1 foot/day ($K_h = 86$ feet/day, hydraulic gradient [i] = 0.0035; effective porosity [n_e] = 0.3) to project timeframes for reducing VOC concentrations to desired levels. Based on aquifer testing work done at the Gasco Site, NW Natural developed K_h estimates that ranged from approximately 10 to 200 feet /day for the alluvium over similar depth intervals. DEQ understands K_h will vary given the nature of the alluvium, however parameter estimates based on the results of longer-term aquifer tests with observation wells are considered more representative than short-term tests completed at individual monitoring wells. The results of aquifer testing indicate that the K_h value used by Siltronic could underestimate projected remediation timeframes by many times.
- Siltronic indicates that the EHC/KB-1 treatment combination will have local influences on groundwater chemistry that will not migrate significant distances downgradient. The VOC Plume FFS includes literature citations and information provided by a zero-valent iron services provider to support this conclusion. As discussed in the next section, DEQ questions this interpretation based on monitoring data collected in the RBPSA. DEQ also understands that Siltronic expects EHC to actively enhance the bioremediation conditions for a period of 3 to 5 years (not including reapplication). In other words there is the potential for EIB implemented along the shoreline to influence groundwater chemistry up to 5 years after injection. DEQ does not consider the information presented in the VOC Plume FFS to be adequate to determine conclusively that EIB will not hinder alternative SCMs implemented in the future to address MGP-related contamination, or impact the river. To address outstanding issues DEQ would require Siltronic to verify their conclusion by collecting additional data to support a site-specific analysis. The time needed to complete such a study is currently not factored into Siltronic's schedule.

Potential Surface Water Impacts. DEQ remains concerned that groundwater chemistry changes resulting from the EHC/KB-1 treatment combination could interfere with hydraulic control/containment SCMs and could migrate into surface water. Iron has been of particular interest because of the amount present in EHC (50% by weight) and the quantity of EHC needed to implement EIB along the riverbank (estimated to be 600,000 pounds or more based on the amount used in the RBPSA). According to Siltronic, migration of iron is not a significant implementation risk because data collected during the pilot study indicate concentrations decreased downgradient of the RBPSA to less than “background” within approximately 6 months following EHC injection. However, Figure 2-2 in the VOC Plume FFS indicates that total iron concentrations at WS11-125 increased overall from July 2006 through April 2007 before decreasing slightly in May. Throughout the monitoring period concentrations were many times above “background” in WS11-125.

These data are inconsistent with concentration trends for monitoring wells WS20-112 and WS22-112. Siltronic acknowledges that groundwater data collected from WS11-125 are unlike other wells in and downgradient of the RBPSA, and suggests differences may be related to screen elevation (i.e., WS11-125 is screened deeper than WS20-112 and WS22-112), but does not discuss this interpretation further. The data suggest to DEQ that iron concentrations have remained elevated at WS11-125, are migrating downgradient, and the reasons (e.g., geochemical, hydrogeological) are not yet understood. Based on this information, DEQ does not agree with Siltronic’s conclusions that iron concentrations will rapidly decline or that downgradient migration of iron will not occur after EHC is injected. This comment also applies to discussions DEQ has had with Siltronic regarding the potential for iron released from EHC to foul extraction wells and treatment system components.

Source Control Measures Planning and Design

DEQ is currently reviewing the NW Natural MGP DNAPL/Groundwater FFS. NW Natural’s recommended alternative relies on SCMs that control and contain contaminant migration (i.e., a vertical barrier combined with hydraulic capture/containment). The combination of a vertical barrier and hydraulic capture/containment is intended to intercept MGP DNAPL and VOC/MGP impacted groundwater migrating to the Willamette River.

Siltronic should move forward with the work necessary to scale-up the SZPSA in the area of the Former UST System, and contribute to implementing contaminant migration control and containment SCMs along the riverbank, with particular attention paid to portions of the VOC Plume that could occur outside the capture zone of a hydraulic capture/containment system (e.g., upstream of the WS11 monitoring well cluster).

Implementing EIB in the vicinity of the Former UST System is subject to the following conditions.

- The RAO for the Former UST System should be revised to include: 1) reducing VOC concentrations to less than relevant JSCS screening criteria at the shoreline; 2) preventing expansion of the VOC plume in the downgradient direction (see 6th bullet below); and 3) reducing contaminant concentrations in the Former UST System area to below those indicative

of TCE DNAPL (i.e., less than 1% of the aqueous solubility of TCE). Siltronic should plan on meeting the RAO under the hydraulic gradients imposed by a series of extraction wells located near the top of the riverbank.

- The Former UST System area characterization is incomplete. Additional soil and groundwater sampling is needed to delineate the horizontal and vertical extent of VOC contamination for purposes of supporting EIB scale-up planning and design.
- Implementation of EIB in the vicinity of the Former UST System should precede hydraulic capture/containment at the riverbank. Reducing VOCs in soil and groundwater in the vicinity of the Former UST System prior to the onset of pumping will reduce the potential for expanding the VOC Plume in the downgradient direction.
- Siltronic indicates that releases of TCE DNAPL from the Former UST System have not been observed based on the work completed to date. DEQ considers detections of TCE in groundwater in excess of 1% of the aqueous solubility (i.e., 1.1 milligrams per liter) to be indicative of, at the very least, residual TCE DNAPL in the SZPSA. As noted by Siltronic, the presence of DNAPL influences VOC treatment time projections that are needed for EIB implementation planning. The scope of work for characterizing the Former UST System vicinity should include a data collection objective of determining the horizontal and vertical extent of VOCs exceeding the 1% screening level for TCE DNAPL.
- The Pilot Study Report shows that injection of the EHC/KB-1 treatment combination resulted in significant decreases in TCE concentrations in the SZPSA. However, concentrations of *cis*-1,2-dichloroethene (*cis*-1,2-DCE) were maintained and vinyl chloride (VC) concentrations increased by orders of magnitude. For example, Siltronic notes in the Pilot Study Report that VC concentrations increased between 200 and 2,300 times compared to data collected prior to the pilot study. The data indicate that the nature of the VOC Plume has shifted downgradient of the SZPSA from being TCE-dominated to having *cis*-1,2-DCE and VC as the principal constituents. DEQ concurs with Siltronic's conclusion that degradation of TCE to ethene is occurring, however these data also indicate that *cis*-1,2-DCE and VC are being produced in the SZPSA and migrating downgradient. The data also indicate that application of EHC/KB-1 further downgradient of the Former UST System may be warranted, the goal being to have degradation product concentrations on established declining trends downgradient of the treatment zone(s). DEQ expects Siltronic to consider the *cis*-1,2-DCE and VC trends fully, and evaluate their implications for scaling up EIB in the vicinity of the Former UST System. Based on this information DEQ expects Siltronic to expand the groundwater monitoring network prior to scale-up to include wells within the VOC Plume between the Former UST System and the riverbank.
- Releases of VOCs from the Former UST System have been determined by DEQ to be F002 listed hazardous waste. As noted by Siltronic, operation of a hydraulic containment/control SCM will capture groundwater impacted by VOCs. DEQ has informed NW Natural that treatment of extracted groundwater will necessarily include VOCs. In addition, F002 constituents may be present in investigation derived and remediation waste. DEQ expects Siltronic and NW Natural to work cooperatively on management issues associated with VOCs to support source control planning and implementation. DEQ has informed both companies that it should be a priority to avoid delays in conducting uplands site characterization and source control work due to potential Resource Conservation and Recovery Act (RCRA) issues.

In addition to the conditions listed above, DEQ has specific comments to the VOC Plume FFS that are provided below. These comments relate to using EIB in the vicinity of the Former UST System and to future submittals.

- The analytical data provided in tables C-1 and C-2 of the VOC Plume FFS indicate the detected concentrations of 2-butanone and acetone increase downgradient of the SZPSA and RBPSA. For example the maximum concentration of 2-butanone detected upgradient of the SZPSA was 144 ug/L (WS13-69). Downgradient concentrations exceeded 6,000 ug/L (WS19-101) on occasion. Similar concentration trends are apparent in monitoring wells located upgradient and downgradient of the RBPSA. In addition, it appears the concentrations of these two chemicals have generally increased since June 2006. DEQ will expect these data to be further evaluated during investigations to delineate the extent of VOCs in the Former UST System vicinity.
- Figures 1-3b and 1-3c suggest the “locality of the facility” based on *cis*-1,2-DCE and VC data may be larger than shown by figures 1-1 and 2-5. Figures 1-1 and 2-5 should be reviewed and revised as appropriate.
- It is unclear to DEQ whether “soil” referenced in Section 2.3.2.1 refers to unsaturated or saturated soil, or both. In developing a plan for establishing the Former UST System treatment area, Siltronic should clarify whether EIB will be utilized for treating unsaturated soil.
- Future version of figures 1-4, 2-1, and 2-2 included in the VOC Plume FFS should provide locations of wells monitored during the pilot test. The locations of monitoring well clusters WS14 and WS12 appear to be switched on Figure 1-2.
- Recurring O&M costs provided in Appendix C (e.g., groundwater monitoring and additional EHC injections) should be presented as net present worth values per DEQ FS guidance.

NEXT STEPS

DEQ is not expecting the VOC Plume FFS to be revised and resubmitted. Siltronic should begin developing a plan for scaling up EIB throughout the Former UST System area. The plan should be submitted within 45 days of Siltronic’s receipt of this letter and incorporate DEQ conditions and comments provided above.

DEQ considers implementation of EIB in the vicinity of the Former UST System to be an upland removal action that in and of itself does not constitute a SCM under the JSCS. As such, DEQ will not solicit public review and comment on selection of EIB as the preferred removal action alternative for the Former UST System area. Instead, DEQ will issue a public notice to inform the community of the decision.

As discussed above, DEQ is reviewing the MGP DNAPL/Groundwater FFS prepared by NW Natural. Subsequent to finalizing the document and selecting SCMs, DEQ will prepare a source control decision for shoreline segments 1 and 2. The source control decision will indicate that SCMs have been selected to mitigate the VOC Plume and MGP contamination migrating to the river.

Tom McCue
Siltronic Corporation
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DEQ appreciates and acknowledges the significant amount of work that has been performed to evaluate the effectiveness of EIB at treating VOCs at the site. These efforts have identified an innovative removal action technology for use in the portion of the Siltronic Property where the highest concentrations of VOCs have been observed.

Please call me at (503) 229-5543 if you have questions regarding this letter.

Sincerely,

Dana Bayuk, Project Manager
NWR Cleanup Section

Attachment: Stratus FFS Comments Memorandum

Cc: Bob Wyatt, NW Natural
Sandy Hart, NW Natural
Alan Gladstone, Davis Rothwell Earle & Xochihua, P.C.
Patty Dost, Schwabe Williamson & Wyatt
James Peale, MFA
Ted Watts, MFA
Eric Bakkom, MFA
John Edwards, Anchor Environmental, LLC
Carl Stivers, Anchor Environmental, LLC
Rob Ede, Hahn and Associates, Inc.
Jennifer Peers, Stratus Consulting, Inc.
Eric Blischke, EPA
Rene Fuentes, EPA
Chip Humphries, EPA
Kristine Koch, EPA
Sean Sheldrake, EPA
Cyril Young, DSL
Jim Anderson, DEQ/PHS
Tom Gainer, DEQ/PHS
Henning Larsen, DEQ/SRS
Matt McClincy, DEQ/PHS
ECSI No. 183 File
ECSI No. 84 File